

ST12 Steam Enhanced Extraction: Has criteria for termination of Steam Injection Been Met?

Status as of 11/6/15 Weekly Progress Report

Criteria for amount of steam to be injected:

Table 5-2 SEE to EBR Transition Criteria Monitoring

Parameter	Target Criteria	Summary of Monitoring or Sampling and Analysis for Evaluation of Progress Toward Transition Criteria
Steam injection (guideline)	319,357,000 lbs	Steam production will be measured at the boilers.

Commented [DE1]: Replace this with section from Table 4-2 of RD/RAWP final, May 2014

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Total Steam Injected	248.4	million pounds (lbs)
Projected Total Steam Injection	320	million lbs
Steam Injected Vs Projected	78	%

Criteria for amount of steam injection has not been met.

Commented [DE2]: Add: The design steam injection rate was based on 1.6 pore volumes of steam injection, which is lower than the commonly used criteria of 2 pore volumes of steam. The projected steam injection should be seen as a minimum amount of steam to be injected.

Criteria for residual benzene concentrations

Benzene concentrations	100 to 500 µg/L	Benzene concentrations will be monitored in SEE wells during baseline sampling. Samples of extracted water (see Table 5-1) will be used to evaluate benzene concentrations during SEE operation. Sampling locations during operation will be determined in the field with a sampling strategy that starts at influent to the liquid treatment system and then moves progressively out to individual manifolds and, in some cases individual wells to trace the source of benzene contribution. The locations will also be selected to evaluate the relative contribution of contamination from outside vs. inside the TTZs.
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Commented [DE3]: Replace this with section from Table 4-2 of RD/RAWP final, May 2014

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Progress Report
 Eastern Community Remediation Project Phase 10/2015
 November 6, 2015

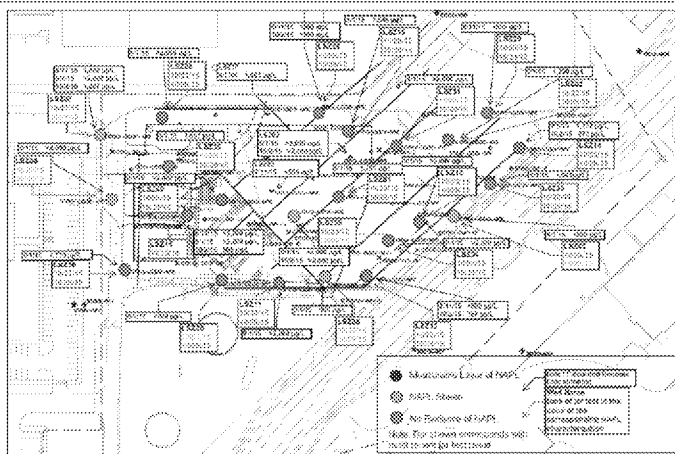


Figure 28. RAMP monitoring depths and calculated benzene concentrations - Lower saturated zone

Benzene Concentrations in LSZ Exceed 500 µg/L; Criteria has not been met for LSZ

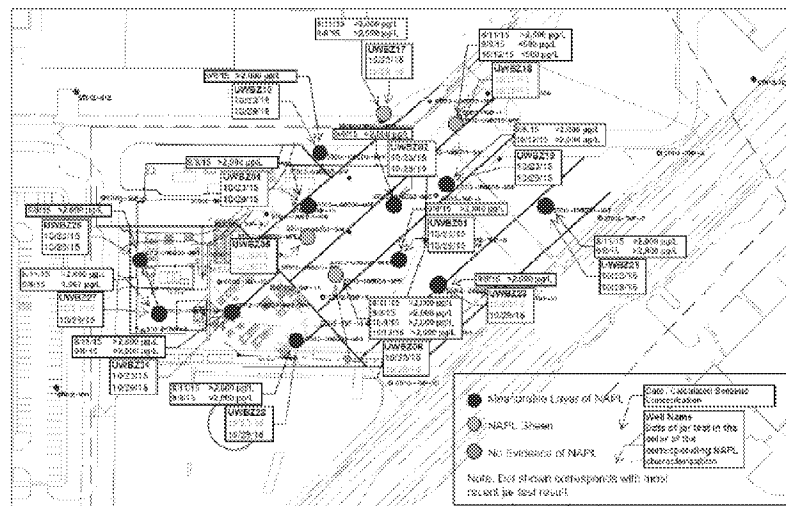


Figure 26. NAPL Screening Results and Calculated Benzene Concentrations – Upper Water Bearing Zone

Benzene Concentrations in UWBZ exceed 500 µg/L; significant NAPL present, Criteria has not been met for UWBZ

22. NAPL Screening Results and Calculated Benzene Concentrations

Figures 27-29 below present the screening level results for NAPL detected in samples collected from same wells across the site. Screening samples are typically collected on a weekly basis. The figures below also include calculated benzene concentrations of groundwater samples collected from same wells across the site.

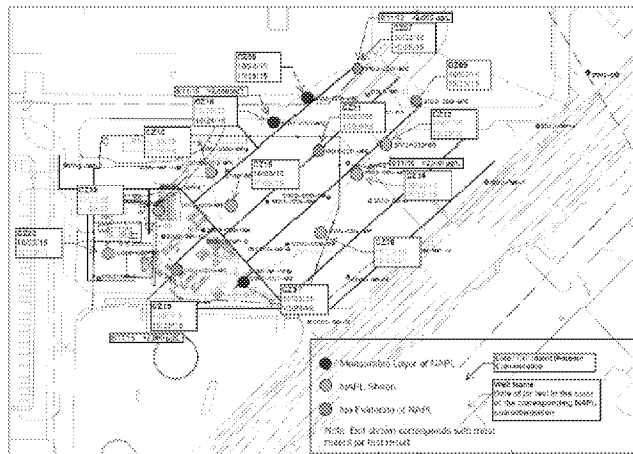


Figure 27. NAPL Screening Results and Calculated Benzene Concentrations – Cobble Zone

Benzene concentrations Exceed 500 µg/L in CZ, NAPL present; Criteria has not been met for CZ

Commented [DE4]: Add, EPA considers 100 ug/l of benzene in groundwater an appropriate target for a successful remediation, and would not support terminating steam treatment before the stated target (100 – 500 ug/l) is reached.

Criteria for Mass Removal

Commented [DE5]: Replace this with section from Table 4-2 of RD/RAWP final, May 2014

Mass removal	Less than 10 percent of peak removal rate	<p>non-peak removal cycles.</p> <p>Mass removal will be determined from a sum of individual mass removal rates such as:</p> <ul style="list-style-type: none"> Recovered LNAPL as measured by totalizing flow meter on the inlet to the LNAPL storage tanks Mass in extracted vapors as measured at vapor collection manifold (vapor flow rate logged in PLC and influent vapor measured by FID/PID) Mass in extracted water as measured in air stripper off gas and liquid laboratory samples (liquid discharge flow rate logged in the PLC, air stripper blower flow rate logged in the PLC, air stripper off gas measured by FID/PID, water treatment influent and GAC influent)
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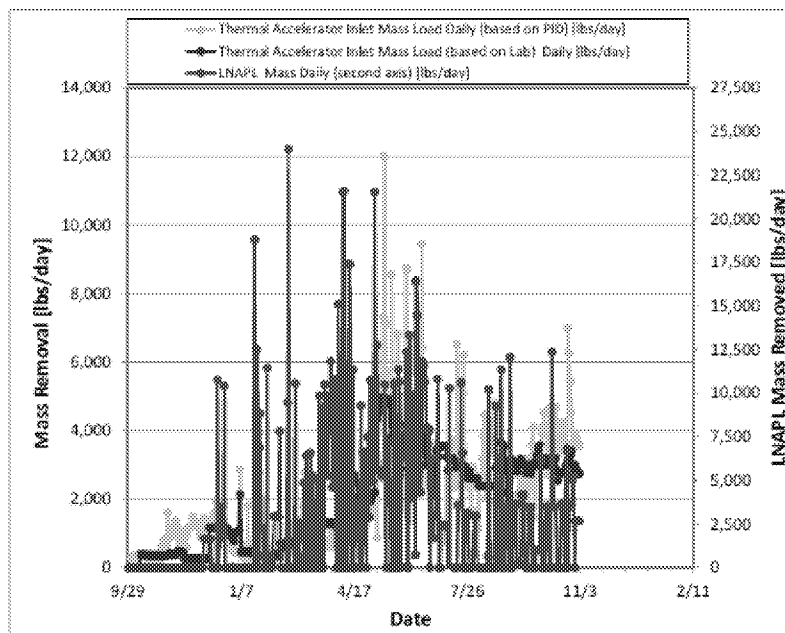


Figure 4. Daily Mass Removed

LNAPL recovery is 30% of peak removal rate; vapor recovery is 50% of peak removal rate; Criteria for termination of steam injection has not been met

Commented [DE6]: Add, EPA considers the criteria of 10% of the peak mass recovery to be high compared to the mass recovery rates that have been used to support thermal treatment termination at other sites. We cannot support termination of treatment when thousands of pounds of contaminant mass are being extracted daily.

Criteria for completion of pressure cycling:

Completion of Pressure Cycling	Completion of multiple pressure cycles in each area	Because the pressure cycling process results in the volatilization of contaminants upon release of the pressure, extracted vapors will be the primary source for measurement of pressure cycling effectiveness. Vapors will be primarily monitored with hand held devices with the objective to demonstrate diminishing returns from pressure cycles.
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Commented [DE7]: Replace this with section from Table 4-2 of RD/RAWP final, May 2014

This criterion is non specific. The purpose of pressure cycling, and indicated in the statements above is to enhance volatilization of contaminants. It is not intended to improve mobilization and recovery of NAPL which may have been retarded by premature initiation of pressure cycling. Ideally, the bulk of NAPL should be removed first before initiation of pressure cycling as the finishing step. As long as NAPL is being recovered, steam injection should continue, then institute pressure cycling to remove the last of the volatiles. It is unfortunate that we did not discuss criteria for initiation of pressure cycling in the workplan.

Commented [DE8]: The criteria in the final version of the RD/RAWP is more specific in stating that "the process is repeated . . .until no additional significant increases in effluent vapor phase concentrations occur when steam pressure is reduced." Figures like those shown on slides 30 and 31 from the last conference call should be used to determine if this criteria has been met. Hasn't as of Oct 15.

Criteria for Boiling Temperatures

Subsurface Temperature	Varies by Depth (higher boiling temperatures with depth – see Figure 5.3, in Appendix D of the RD/RAWP)	17 individual TMPs will be equipped with 15-24 vertical temperature measurement locations per TMP. In addition, each SIW and MPE well will be equipped with the infrastructure for a co-located TMP to be installed for temperature measurements to be collected. Co-located TMPs will be permanently installed for the 18 deep SIWs in the LSZ and will monitor the temperature at the top, middle and bottom of these wells. Two mobile temperature arrays in the CZ and two mobile temperature arrays in the UWZ will be used to monitor temperatures in the remaining MPEs and SIWs (top, middle and bottom depths). Temperature monitoring of the SIW/MPE wells, along with extracted fluid and vapor temperatures, will supplement the 17 individual TMPs to monitor temperature distribution at the site.
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Commented [DE9]: Replace this with section from Table 4-2 of RD/RAWP final, May 2014

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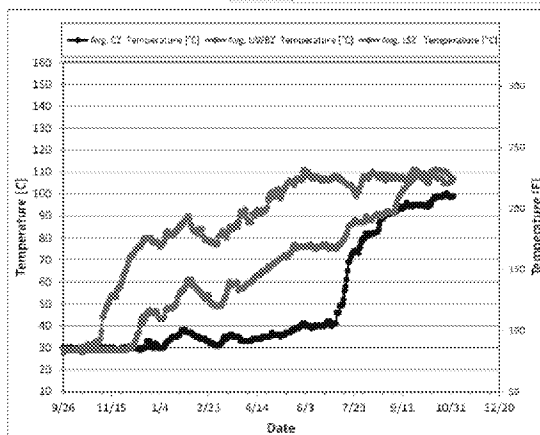


Figure 6. Average Soil Temperatures

Criteria for Boiling Temperatures has just barely been met.

Commented [DE10]: According to slide 20 from Oct 15, the target temperature for the CZ is ~ 100C, which has almost been met. The target for the UWZ is ~114C, which I don't believe has been met. The target for the LSZ is ~134C, which has not been met.

